Correction : Music

1. Sound is a **mechanical wave** because its propagation requires a medium in which matter oscillates in place without any transport of matter but only transport of energy. It is a **longitudinal** wave as the disturbance (forming areas of compression and rarefaction) act parallel to the direction of propagation of the wave.
2. A pure sound is produced by a tuning fork or electronically with an oscillating circuit; it plays a sound characterized by only one specific frequency; observed on an oscilloscope, it shows a nice sinusoidal curve.
3. A noise is a complex sound that doesn't present any kind of periodicity in time while a musical sound takes its musicality from its inherent period even if the signal itself is complex.
4. The period of a wave is the duration corresponding to a complete oscillation. Frequency is the number of oscillations per second; if the frequency is 440 Hz, the period is:
   $T = \frac{1}{f} = \frac{1}{440} = 2.27 \times 10^{-3}\text{s} = 2.27 \text{ ms}.$
5. The spectrum of a sound is represented by a graph called a bar chart, where the amplitudes of the harmonics are displayed on the ordinate axis and the frequencies of the harmonics on the abscissa axis. This graph is based on the principle that any periodic signal can be decomposed into an infinite sum of sinusoidal waves, whose frequencies are integer multiples of the signal's fundamental frequency. This principle is known as the Fourier theorem or Fourier analysis, named after the French mathematician Joseph Fourier.
6. The same note played by two different music instruments such as a guitar and a violin distinguish themselves by their timbre; an analysis of these sounds shows that their spectra differentiate by the amplitudes of their frequency components. While the pitch of the note may be the same (same fundamental frequency), the timbre is what makes them sound distinct.
7. The wavelength is the period in space; it is the distance between two consecutive places that vibrate in phase, two consecutive peaks or two consecutive troughs:
   $\lambda = v \cdot T = \frac{v}{f}; \lambda = \frac{340}{440} = 0.72 \text{ m}$
8. A logarithmic scale is used to measure the intensity of sound because this kind of scale considers the non-linear sensitivity of the human ear; such a scale is called a physiological scale. A sound level of around 90 decibels (dB) is commonly cited as the threshold for potential hearing damage over prolonged exposure. Prolonged exposure to sounds at or above this level can lead to irreversible hearing loss or other auditory problems. It's essential to protect your ears from prolonged exposure to loud sounds, especially in environments such as concerts, construction sites, or when using noisy machinery, to avoid potential damage to your hearing.

Exercise 1: $I(\text{W} \cdot \text{m}^{-2}) = \frac{P(\text{W})}{4\pi \cdot r(\text{m})^2}$ and $L(\text{dB}) = 10 \cdot \log\left(\frac{I(\text{W}\cdot\text{m}^{-2})}{I_0(\text{W}\cdot\text{m}^{-2})}\right)$. If the number of sources of the same power is doubled, the intensity is doubled. Therefore, the level of sound increases by a factor of $10 \cdot \log 2 = 3$ dB. To obtain an increase from 70 dB to 82 dB, we need 4 times an increase of 3 dB; it means the number of sources is doubled successively 4 times that is 16 times. Therefore, 16 radios functioning together would create an 82 dB level of sound intensity at the same distance.

Exercise 2: If the distance from the source of sound is doubled, the intensity is divided by four as the intensity is inversely proportional to the square of the distance. Thus, the level of sound diminishes by a factor of $10 \cdot \log(4) = 6$ dB. To make the level of sound drop from 90 dB to 32 dB, that is an 18 dB decrease, the auditor would need to move away from the stage 3 times, by a factor of 2, which results in being 8 times farther from the stage. If the initial distance from the stage was 1 m, then after moving away 3 times, the distance would be 1 m×2^3=8 m.